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Financial Decision Making when Buying and Owning a Home**

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The Mistakes People Make: Financial Decision Making when Buying and Owning a Home¹

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Keywords: Household Finance, Mortgages, Refinance, Option Value, Financial Crisis

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1. Introduction

Buying a home is perhaps the most important financial decision a household makes (Campbell 2006). But purchasing a home entails many decisions beyond simply deciding how much to pay for a house. For example, if the purchase is financed with a mortgage (over 90% of homes purchases have a mortgage), the homeowner must shop for the best available mortgage rate as well as decide on a second mortgage versus mortgage insurance, the size of the down payment, and how much to pay in points and fees. Subsequent to the purchase, the homeowner must also make decisions to refinance (e.g. Deng Quigley and Van Order, 2000; Agarwal, Driscoll and Laibson, 2013; Agarwal, Rosen, Yao, 2014; Andersen, Campbell, Meisner, and Ramodaria, 2014) and, in some cases, to default (Guiso, Sapienza, and Zingales, 2009).

Recently there has been much interest in how financial literacy and sophistication, or the lack thereof, contribute to household financial decision making. The extant survey evidence suggests that the financial literacy of the U.S. population is low and that most households lack financial sophistication (see, for example, Hilgert, Hogarth, and Beverly, 2003; and Lusardi and Mitchell, 2009). For example, many individuals do not hold checking accounts (Hilgert et al., 2003), others accept payday loans with astronomical APRs when alternative cheaper forms of credit are available (Agarwal, Skiba, and Tobacman, 2009; Bertrand and Morse, 2009), and consumers with multiple credit card offers fail to optimally choose the right credit card (Agarwal et. al., 2006). More broadly, it is puzzling that less than 30 percent of U.S. households directly participate in equity markets (Cole and Shastry, 2009; Li, 2009) and among those who do hold stocks, many have highly concentrated portfolios and trade excessively (Korniotis and Kumar, 2010 and 2013).

Suboptimal household financial decision making behavior has important and potentially wide-ranging ramifications for society. For example, the ability of families to adequately invest

in their children's human capital or for older individuals to optimally secure retirement income is undoubtedly affected, at least in part, by the quality of financial decision making. There is also heightened interest among policy makers in restraining excessive consumer debt that can lead to bankruptcy and home foreclosures. Recent economic events suggest that suboptimal financial behavior among households in the residential mortgage market may have contributed to large spillover effects on the aggregate economy. Despite the growing salience of the issue, our current understanding of exactly what factors might account for suboptimal financial behavior is limited.

One potential explanation is that high levels of very specific cognitive abilities may be a prerequisite for making optimal financial choices. For instance, in choosing an investment portfolio, an investor must synthesize a wide range of information concerning economic conditions and the past performance of various assets, while accounting for transactions costs, asset volatility, and covariance among asset returns. This task requires memory, computational ability, as well as financial sophistication. Cognitive limitations might also lead consumers to make suboptimal credit decisions, perhaps because they overestimate their ability to repay loans or fail to translate monthly payment rates into annualized interest rates (Ausubel 1991, Agarwal et. al. 2006, and Bertrand and Morse, 2009).

In general, poorer and less educated individuals tend to be less financially sophisticated and have low cognitive ability and are, for example, less likely to plan for retirement (Lusardi and Mitchell (2007)) or invest in common stock (van Rooij, Lusardi, and Alessie (2011)) while being more likely to borrow at high-cost rates (Lusardi and Tufano (2009)) or invest in mutual funds with higher fees (Hastings and Mitchell (2011)). However, apart from a household's mortgage refinancing decision (Andersen et. al., 2014), the bulk of the research on the effects of sophistication on financial decision making has shied away from a household's most important financial decision, buying a home.

This paper investigates the mistakes households make across many of the financial decisions involved when buying and owning a home. We use schooling and work experience as our proxies for financial sophistication. We do not rely on survey evidence but rather base our analysis on the actual decisions made by households in the economic environment prevailing when their decisions were made. These mistakes include (i) paying too much for a house (ii) or too high a rate of interest, points and closing costs on the mortgage used to finance the purchase, (iii) not refinancing a mortgage when it is financially advantageous to do so, and (iv) not exercising the homeowner's default option when it is financially optimal to do so.

Financial sophistication can be measured in a variety of ways. More educated individuals, especially college graduates, are more likely to be financially sophisticated. But exposure to finance in the workplace (Bernheim and Garrett (2003)), and investing in common stock are also linked to financial sophistication (van Rooij, Lusardi, and Alessie (2011)). In general, there is now growing evidence that cognitive ability is an important predictor of financial outcomes (Benjamin, Brown, and Shapiro, 2013; Cole and Shastry, 2009; Frederick, 2005).

Measured either by schooling or experientially, we find that financial sophistication does not have a uniform impact across households' financial decisions. While financially sophisticated households are more likely to make good mortgage rate and refinancing decisions, they are also more likely to pay too much for their houses and sluggishly exercise their default options. Minority borrowers and older borrowers appear to consistently make financial mistakes across a majority of their decisions. This latter result is consistent with Lusardi, Mitchell, and Curto (2012)'s conclusion that older Americans are particularly lacking in financial sophistication.

We also explore whether homeowners learn when making financial decisions. For a

subset of homeowners, we observe the prices at which they subsequently sold their houses for. Using these repeat sales observations, we compare a homeowner's own rate of house price appreciation to that of other houses sold nearby and regress these excess rates of appreciation against financial sophistication and other borrower characteristics. While financially sophisticated households tend to over pay for their houses, we find that, consistent with learning, by the time they sell their houses, they earn a rate of appreciation either no different from or even in excess of that of other houses sold nearby. In addition, comparing the decisions of first-time versus repeat homebuyers, we observe that households learn to make better mortgage rate and refinancing decisions with their subsequent purchases.

Taken together, our results suggest that the nature of the financial decisions confronting households differ from one another. Purchasing a home, for example, is an emotional decision. Defaulting on a mortgage is also subject to moral considerations while imposing long-term economic costs on households. By contrast, deciding on a mortgage and when to refinance are more analytical decisions and, as such, are more amenable to the analyses that more sophisticated households are able engage in. These opposing effects that financial sophistication has on purchase price and default mistakes versus mortgage rate and refinancing mistakes preclude us, unlike Calvet, Campbell, and Sodini (2009), from being able to construct an index or summary measure of borrower characteristics explaining mistakes across all four of our decisions.

The plan of this paper is as follows. Our data are introduced and discussed in section 2. Section 3 provides univariate empirical analyses of the mistakes households make in their house purchase price decision, mortgage rate decision, refinancing and default decisions, respectively. Their ability to learn from these mistakes is also investigated. We turn our attention to simultaneously analyzing these decisions in section 4 and ask whether there are observable

characteristics that impact the likelihood of a household making mistakes across all four decisions. We conclude in section 5.

2. Financial Decisions for Buying and Owning a Home

There are many decisions that households need to make in managing their real estate portfolios beginning from the day they became a homeowner or investor. Figure 1 lists five key financial decisions that span the experience of buying and owning a home:

- How much does a homeowner pay when purchasing a home?

The criteria used in the literature to evaluate this decision includes the percentage difference between purchase price and fundamental value measured by an automated valuation model (AVM) (e.g., Griffin and Maturana, 2014), the sale to list price ratio, and home price appreciation, either from prior sale to current sale or from current sale to future sale. This paper studies the patterns of over-paying relying on the percentage difference between purchase price and AVM as well as home price appreciation.

- Mortgage terms when financing the home purchase with a mortgage.

Given that a mortgage is such a complicated financial contract, there are many terms with respect to which the borrower may not make optimal decisions; for example, whether paying points upfront versus a higher note rate (e.g., Agarwal, Ben-David and Yao, 2014), whether to choose a fixed rate versus an adjustable rate mortgage (e.g., Badarinza, Campbell and Ramadorai, 2013), whether to get a piggyback loan to avoid paying private mortgage insurance as opposed to a single lien but at a higher loan to value ratio, or whether to accept a mortgage rate much above or below the expected level his or her peers are paying. This paper investigates the patterns as to why certain borrowers pay a too high mortgage rate.

- Refinancing decision throughout the lifecycle of the mortgage.

There have been a number of papers studying the incidence of refinancing mistakes. These mistakes fall into two main categories. Borrowing the terminology of Agarwal, Rosen, and Yao (2014), errors of commission are refinancing decisions that result in interest rate savings, but at rates below the optimal threshold (Agarwal, Driscoll, and Laibson or ADL, 2013), while errors of omission are failures to refinance that occur above the ADL threshold. Andersen et al (2014), using Danish data, find that education and income reduce both inertia and inattention in refinancing decisions, but the effect of education is greater among more educated households, while the effect of income is greater among poorer households. We perform a similar analysis using US data and, in addition, in the broader context of all financial decisions made by households in buying and owning their home.

- Default decisions at various levels of current home equity.

The literature on the determinants of mortgage default (as well as the development of corporate default models) has been evolving for the past 30 years. Foster and Van Order (1984 and 1985) were among the first to model mortgage default as a put option. When a homeowner has a mortgage, and can extinguish all of her obligation by putting a house back to the lender, she has a put option as well as equity in the house. Kau, Keenan and Kim (1993) and Kau and Keenan (1999) show that even in the absence of transactions costs, borrowers will not necessarily default immediately when this option is in-the-money. Quigley and Van Order (1995) illustrate the optimal default strategy when interest rates are constant, suggesting that once house values move below a threshold point, other issues, such as original loan-to-value ratio, should not affect mortgage behavior. Agarwal et al (2014), however, find that after controlling for mark-to-market asset valuation, initial collateral

remains an important predictor of mortgage default. Specifically, individuals that pledge higher collateral have a lower hazard to default and thus exhibit a sunk cost fallacy. This paper specifically analyzes the default behavior at different put option values relying on a standard default model.

3. Data

We investigate decisions made by households with mortgages drawn from the population of all mortgages securitized by a national insurer between the years 2001 and 2011. Borrowers enter into a mortgage contract for one of the following reasons: to purchase a house, to refinance in order to lower a payment or rate, to refinance to extract home equity, or to use home equity as a line of credit. In this paper, we restrict attention to those mortgages used to finance a house purchase so that we can analyze borrowers' house purchase price decisions as well as mortgage note rate decisions. Homebuyers can be first-timers or existing homeowners. Each of the mortgages is then tracked until the borrower exits the loan by either prepaying or defaulting. These prepayment and default decisions are also analyzed. The mortgages are fully documented conforming loans made to prime borrowers. That is, the mortgages meet the conforming loan limit that since 2006 has been set to \$417,000 for a one-unit house located in a non-high cost area. Prime borrowers have a relatively high credit score (620 or higher) when compared to subprime borrowers with blemished credit records.

For each of these mortgages, we also observe the borrowers' loan application information. This information includes a borrower's years of schooling, occupation, verified income and its sources, as well as the household's verified balance sheet at the time of application. A borrower's income sources include, among other items, base salary and any bonuses. Assets include, for example, cash, common stock, or automobiles. Based on years of schooling, we

classify borrower's education as resulting in a high school diploma or a college degree and above. We also calculate the percent of stocks in the borrower's total asset holdings. In particular, if a borrower owns more than 10% of assets in stock, we label them as "Owning Stock", and take this to be a measure of experience in financial investments and an indication of financial sophistication. In addition, we also standardized the applicant's raw and often noisy occupation information to Census job codes. Based on typical keywords such as "CFA", "CPA", "Financial Advisor", "Investment Analyst" etc., we create an indicator as to whether the borrower is employed in the financial services industry, and also rely on this as an indication of financial sophistication.

Over the life of the mortgage, we observe the marked to market LTV and CLTV (*MtM-CLTV*) based on current balance and current property values. The latter is typically estimated using repeat sales indices (such as Case-Shiller Home Price Index). *MtM-CLTV* has been used as a measure of the degree to which a homeowner's put option to default is in-the-money. Subsequent to origination, we also observe the changes in rates from the existing note rate on the mortgage to prevailing market rates. This captures potential interest savings from refinancing and so the value of homeowner's call option to prepay. We also match unemployment rates at the MSA level and use the change in these unemployment rates as a control for labor market or income shocks.

At the termination of the mortgage contract, one of three events can occur: default by stopping to make payments, refinance the old mortgage with a new mortgage, or sell the property and pay off the mortgage with the resultant sales proceeds. We define the mortgage to be in default if the borrower misses at least three payments (serious delinquency or SDQ) or the property is in foreclosure. We also identify the date and price when the property is sold using available public records. From this information, we can calculate the price appreciation for the

re-sales subset as measure of total return from the real estate investment.

3.1. Sample Statistics

Sample statistics describing our data are provided in Table 1. We see that the average price paid for a house in our sample is approximately \$266,000 and is financed with a mortgage carrying a note rate of slightly less than 6%. Not shown is that the average loan-to-value (LTV) ratio at the initial purchase is 84% and a large majority of the mortgages (86%) are thirty-year fixed rate mortgages. Over 8% of the sampled mortgages defaulted while more than a third were prepaid during our sample period.

With regard to borrower characteristics, almost half of the borrowers are under the age of thirty-five and about 2% are sixty-five years of age or older. Approximately 40% are first-time homebuyers. Minorities - primarily African Americans and Hispanics - represent about 15% of the sample. The number of borrowers is usually a good proxy for household size. In our sample, one third of the mortgages have more than one borrower. The average gross income is approximately \$4,200 monthly or \$50,000 annually.

Better-educated individuals should be less prone to make financial mistakes. In that regard, over 54% of our sampled borrowers have high school diplomas but did not continue on to college. Almost 20% did graduate from college or higher. However, financial sophistication can often be attained experientially. For example, 8.3% of the borrowers are employed in the financial services industry and their day-to-day work activities and interactions with colleagues should result in greater financial sophistication. Alternatively, the extent to which individuals invest in common stock is another measure of financial sophistication. For 6.2% of the households, common stock investments represent at least 10% of their assets. We expect these borrowers to also be more financially sophisticated.

Although not reported, we examined pair wise correlations between these variables. A number of interesting patterns emerge. For example, the note rate is negatively correlated with the initial price paid for the house capturing the fact that households with greater incomes and so a better credit risk tend to purchase more expensive homes. Consistent with the note rate reflecting values of options to default and to prepay, we see that higher note rates are positively correlated with higher propensities to default and to prepay. Minorities, however, tend to pay higher note rates although they tend to refinance less often but default more frequently. As expected, young borrowers are more likely to be first-time homebuyers and earn lower incomes. Also, we see that college graduates tend to earn higher incomes and, as expected, purchase more expensive homes.

3.2 *Statistics by measures of financial sophistication*

For an alternative view of our data, Figure 2 plots the average raw price, note rate, cumulative refinance and default/foreclosure rates by percentiles of five variables that tend to correlate with financial sophistication – income, FICO score, years of schooling, borrower age and mortgage importance². As expected, individuals with higher incomes purchase more expensive homes and, in general, pay a lower note rate on their mortgages (see Figure 2(a)). However the difference in these note rates is a mere 30 bps - not a large difference. There is also a direct relation between cumulative refinance rates and income, but a negative relation between cumulative default rates and income. The former suggests that higher income borrowers are, in general, savvier in taking advantage of lower rates while the latter may suggest that their homeownership is more stable.

The behavior of cumulative refinance rates by FICO score is similar to that by income. It

²Defined as the ratio of loan amount to annual income.

peaks at around the 80th percentiles of both income (~\$6,500 monthly or ~\$80,000 annually) and FICO score (~760). Afterwards, the refinance rate drops slightly. There is also a direct relation between FICO score and the price of properties that borrowers buy but the relation is not strong. FICO score appears to be the most important predictor of the default rate among all five variables. Not only is the relation negative, but the default rate varies significantly with FICO score, ranging from 1.5% for the highest FICO score borrower to 31% for the lowest FICO score borrower—a factor of 20 times.

There is also a high correlation among years of schooling, FICO score and income. More educated borrowers tend to buy more expensive homes, refinance more often, and default less. The relation with borrower age is more of a lifecycle story. For borrowers between 20 and 38 years of age, when families are formed and expanded, there is a greater need for larger and hence more expensive homes. Younger households are also more financially constrained. From Figure 2(d), younger aged individuals have higher refinance and default rates. In Figure 2(e), mortgage importance is seen to increase with purchase price. There is a positive correlation between both prepayment and default rates with mortgage importance. Borrowers with higher leverage are more likely to default, but at the same time, they are more incentivized to pay attention to interest rate changes in order to realize the greater gains resulting from refinancing.

Overall, we see that purchase price is most correlated with income, the default rate is most correlated with FICO score, while the refinance rate is most correlated with education.

4. Individual Mistakes

4.1. Purchase Price Decision

Each mortgage in our sample is originated to finance the purchase of a house. We compare the home's purchase price to its fundamental value as estimated by a hedonic price function to determine whether the borrower underpaid or overpaid for the property. Borrowers are classified as having made a purchase price mistake if the price they paid exceeds this fundamental value by at least 15%. Requiring the purchase price to differ from its fundamental value by at least 15% allows us to also account for any estimation or other errors in our hedonic price function. According to this criterion, 12.0% of the borrowers in our sample made a purchase price mistake. Conversely, 21.2% of the sampled borrowers made a good purchase price decision in which their purchase price was at least 15% lower than the home's fundamental value.

Figure 3 plots the average rate of house price mistakes by the five financial sophistication variables - income, FICO score, years of schooling, borrower age and mortgage importance. There we see that the likelihood of overpaying for a house increases in income, FICO score, schooling, and mortgage importance, but appears to be insensitive to borrower's age. Our subsequent empirical analysis will explore these relations more carefully.

It is important, however, that our conclusions are robust and not sensitive to the choice of the amount by which the purchase price must differ from a home's fundamental value before concluding that a borrower made a good or bad decision. To do so, we repeat the analysis with both a tighter criterion of at least a 25% difference between the purchase price and fundamental value as well as a looser criterion of only a 5% difference.

4.1.1. Hedonic House Valuation Model

The hedonic price function is based on Rosen (1974)'s seminal work on estimating the marginal utility of an attribute of a good that possesses a bundle of attributes. Hedonic models have been widely used to value residential real estate. Follain and Malpezzi (1980) tested a linear functional form of the hedonic price function to value residential real estate versus a log-linear specification and concluded that the log-linear form has a number of advantages over the linear form.³ Accordingly, we write the price of house i , p_i , located in a particular county j at transaction month t as:

$$p_i \equiv \log(P_i) = \sum_k b_k \times x_{ik} \quad (1)$$

where x_{ik} is the k^{th} structural characteristic or amenity of the house⁴ while b_k is the characteristic's estimated value.

Our hedonic model is based on the following characteristics of the purchased home: log square footage, log lot size, number of bedrooms, age of the property and the squared age of the property. We use census block group (CBG) dummies as location controls and monthly dummies as time controls. Since there are too many location dummies for a single hedonic model to be estimated for the entire nation, we estimate one hedonic price model per county in which we have sampled purchase transactions.⁵ Also, because we use the hedonic model in real time, each purchased property is valued using data available up through the month prior to the corresponding transaction month.

³These include allowing the value of an attribute to vary proportionately with the size and quality of the house, mitigating heteroscedasticity in the model's error terms, and the ease with which the model's coefficients can be interpreted.

⁴Including its location j and the time of the transaction t

⁵There are over 3,000 counties in the U.S. and our sampled purchases occurred in approximately 1,100 of these counties. Therefore, we estimate approximately 1,100 county-specific hedonic house price functions.

The estimated hedonic model explains a substantial portion of the variation in actual house prices with an overall adjusted R^2 of 83.4%. By construction, conditional on a property's observed characteristics, house prices predicted by the hedonic model provide an unbiased estimate of actual house prices in the overall sample. Therefore, mispricing can only arise because of unobserved property characteristics or information on buyers and sellers that are not accounted for in the model but that can influence house prices. For example, recent research on foreclosure contagion has shown that a house will sell for less if it is near a foreclosed property or when the owner is bankrupt or deceased (Harding, Rosenblatt, and Yao (2009) and Campbell, Giglio, and Pathak (2011)). To the extent that these factors are not captured in our hedonic model, we may misprice these properties.

To investigate the pricing properties of our hedonic model as a function of observed purchase prices, the corresponding prediction errors of our sampled houses, measured as actual prices minus predicted prices, are divided by their actual prices. The mean and median of the resultant normalized price prediction errors are -4.6% and -1%, respectively. So while our model, on average, prices houses correctly across the entire sample, these results suggest that it underprices higher priced houses and overprices lower priced houses. However, the prediction errors as a share of observed prices are minimal with those of lower priced houses being of greater magnitude than those of higher priced houses.

Finally, since extreme house price values usually suffer from significant measurement errors, we perform a 98% Winsorization based on the normalized predicted price errors.

4.1.2. Results

Table 2 compares the differences in explanatory variables between borrowers making bad versus good decisions across all of our four decisions. With regard to the purchase price decision,

while there is a statistically significant difference in purchase prices, there are no statistically significant differences in the corresponding borrower characteristics. As can be seen in Table 2, this same observation applies to the other three decisions. In other words, no single characteristic can fully explain bad decisions made by households.

Accordingly, Table 3 gives the results of estimating a Logit model in which we investigate which variables together contribute to the likelihood of a borrower making a bad purchase price decision as opposed to a good purchase price decision. In particular, the log-odds of a borrower making a bad decision are calculated relative to those borrowers classified as making a good decision. We then let these log-odds be linear functions of our explanatory variables. A positive coefficient on a particular variable is consistent with a higher likelihood of a mistake or, equivalently, a lower likelihood of a good decision.

From Table 3 we see that financially sophisticated borrowers are actually more likely to make a purchase price mistake and overpay for their houses. For example, increasing an individual's years of education increases the likelihood of their making a house price mistake. This conclusion remains statistically significant at both the tighter and looser criteria for a price mistake. Borrowers who attain financial sophistication experientially also tend to make purchase price mistakes although the effects are not as pronounced. Common stock ownership has a statistically significant effect that weakens at the tighter criteria while financial service industry employment does not appear to have any effect. In contrast, first-time homebuyers who, by definition, have the least experience in purchasing a house are seen to be more likely to make a good decision. This suggests that first-time homebuyers expend the time and effort necessary to avoid overpaying for their first home.

We also see that borrowers with higher incomes are far more likely to overpay for their

homes. This conclusion also holds for both the tighter and looser criteria for a price mistake. While borrowers with higher incomes tend to purchase more expensive houses and so are more likely to overpay, taking into account the various hedonics that result in a more expensive house price controls for this tendency. Similarly, borrowers with higher FICO scores are more likely to overpay for their homes.

The age of the borrower does not influence the likelihood of making a house purchase price mistake. However, minority borrowers are more likely to make a purchase price mistake and overpay for their houses. More significantly, having more than one borrower increases the odds of making a bad purchase price decision. Therefore, the dynamics between couples and larger families are more likely to result in them overpaying for a home.

4.1.3. Repeat Sales

For a subset of borrowers, we not only observe the prices they paid for their homes but, relying on public records, we also have the prices they sold their homes for. Using these pairs of repeat sales, we now investigate the extent to which financial sophistication and other borrower characteristics contribute to a household being able to earn a rate of appreciation on their house that exceeds that of other nearby houses.

To do so, we use a two-stage estimation procedure. In the first stage, a homeowner's own house price appreciation is compared to the rate of appreciation earned on other houses sold in the same Metropolitan Statistical Area (MSA). The rate of house price appreciation in a MSA is estimated using the repeat sales methodology of Case and Shiller (1987) and others to control for both observed as well as unobserved house characteristics. Because we do not have enough repeat sales observations in many MSAs to estimate the repeat sales model by MSA, we include

MSA fixed effects in this first stage regression.⁶ Each house's actual rate of appreciation is then compared to its MSA's estimate of house price appreciation to obtain the excess rate of appreciation, either positive or negative, earned by the borrower. We then regress these excess rates against financial sophistication and other borrower characteristics in the second stage. The results are presented in final column of Table 3.

Interestingly, while financially sophisticated borrowers tend to over pay for their houses, we see that by the time they sell their houses, they earn a rate of appreciation in excess of or not statistically different from that of other houses sold in their MSAs. For example, more educated borrowers and borrowers who own common stock earn statistically significant excess returns, as do borrowers with higher incomes and higher FICO scores. Taken together, these results suggest that financially sophisticated borrowers are able to learn from their purchase price mistakes and subsequently make good house sale price decisions.

Because first-time homebuyers are more likely to make good house purchase price decisions, we see that they also earn significant positive excess returns. Minority borrowers are also seen to earn significant positive excess returns. This result may be consistent with the fact that they are able to sell their homes to other minorities at sufficiently high prices to more than compensate for their initial purchase price mistakes. On the other hand, older borrowers earn significant negative excess returns. That is, while older borrowers do not tend to make price mistakes when purchasing their homes, they tend to make price mistakes when selling their homes. This result may reflect the fact that older borrowers are pressured to sell their homes under duress brought about by illness or death.

⁶Similar results are obtained when we estimate the repeat sales regressions on a state-by-state basis. However, statistical significance is reduced.

4.2. Mortgage Rate Decision

Borrowers are classified as having made a bad mortgage rate decision if their note rate exceeds by 50 basis points (*bps*) the note rate obtained by their peers for the same mortgage product. Based on this criterion, 8.8% of our sampled borrowers made a bad mortgage rate decision. Conversely, 9% of the sampled borrowers made a good mortgage rate decision in which their mortgage rate was at least 50 *bps* less than their peers' note rate for the same mortgage product. We also repeat the analysis with both a tighter criterion of a 75 *bps* difference and a looser criterion of a 25 *bps* difference between borrowers' and their peers' notes rates. A peer's note rate is based on an estimated mortgage rate model that we discuss next. In Figure 3, the raw mortgage rate mistakes can be seen to decrease in income, FICO score and schooling but are insensitive to age and mortgage importance, suggesting that more financially sophisticated borrowers make better mortgage rate decisions.

4.2.1. Mortgage Rate Models

Estimating mortgage rates is made complicated by a borrower's choice of points and closing costs as well as the influence of the mortgage-backed securities (MBS) market in which the loan is subsequently pooled. These factors all affect what rate a bank offers with rates differing from one bank to another and even varying by the hour.

In an attempt to control for these factors, we separately estimate mortgage rate equations for mortgage products according to the following industry-based MBS pool classifications: 30 year fixed rate mortgage (FRM) (239,870 observations), 20/25 year FRM (2,380 observations), 10/15 year FRM (13,062 observations), 1/1-5/1 adjustable rate mortgage (ARM) (18,537 observations) and 7/1-10/1 ARM (4,665 observations). Using ordinary least squares regression, we estimate the corresponding note rates based on the following loan and borrower

characteristics relied upon in many banks' loan underwriting: the borrower's FICO score, the loan's initial LTV ratio, the loan's "backend" or debt-to-income (DTI) ratio, an investor dummy variable, a condo dummy variable, a single family home dummy variable, a broker loan dummy variable, an interest only (IO) dummy variable as well as quarterly dummy variables.

The estimated mortgage rate models' adjusted R^2 s range from 58.3% (1/1-5/1 year ARM) to 79.2% (10/15 year FRM), suggesting that the simple rate equation provides a good fit for each of the mortgage products. For example, the model's adjusted R^2 for 30 year FRMs, the mortgage product used by a large majority of our sampled borrowers, is 69.6%. In general, across all mortgage products, borrowers pay a higher note rate when FICO scores are lower, initial LTV and DTI ratios are higher, the loan is collateralized by an investor property, is a broker loan, and has an interest only option.

The mean and median of the predicted rate errors, defined as actual rate minus predicted rate, across all of the mortgage products are -0.05 bps and -2 bps, respectively. The corresponding 1st and 99th percentiles of these rate errors are -1.06% and 1.15%, respectively, indicating as well that the estimated models provide a good fit to the mortgage rate data. We also perform a 98% Winsorization based on the rate errors to minimize the influence of possible unobserved points or closing costs which may be reflected in the observed note rates.

4.2.2. Results

Table 4 gives the results of estimating a Logit model investigating the variables that contribute to the likelihood of a borrower paying a higher mortgage note rate as opposed to a lower mortgage note rate for the same mortgage product when compared to the borrower's peers. The results here suggest that financially sophisticated borrowers are far less likely to make a mortgage rate mistake. For example, educated borrowers are less likely to make a bad mortgage

rate decision. In particular, increasing a borrower's years of education significantly reduces the likelihood of mortgage rate mistake. These conclusions hold at both the tighter and looser criteria. Consistent with these findings, Campbell (2006) also documents that better educated borrowers self-report having lower mortgage rates.

Borrowers who attain financial sophistication experientially also tend to make better mortgage rate decisions. For example, borrowers who own common stock or who work in the financial services industry are significantly less likely to make a mortgage rate mistake. By contrast, being a first-time homebuyer, all else being equal, increases the odds of paying a higher rate than the one's peers. The increased likelihood of first-time homebuyers making a mortgage rate mistake holds for both the tighter as well as the looser criteria.

The odds of a borrower making a mortgage mistake is also lower the higher the price of the house. This conclusion holds even though borrowers with higher incomes, who are likely to purchase more expensive houses, are more likely to pay a higher mortgage rate.

Other borrower characteristics play an important role in influencing the nature of the borrower's interest rate decision. In particular, the age of the borrower matters with older borrowers more likely to make a bad mortgage rate decision. Once again, minority borrowers are seen to be more likely to make a financial mistake, here being far more likely to pay a mortgage rate higher than that paid by their peers. This effect is economically and statistically significant across both of the assumed criteria. Campbell (2006) also finds that non-white borrowers self-report higher mortgage rates but the age of the borrower does not play a significant role in his results. Finally, the greater the number of individuals that sign a mortgage contract, the more likely the borrowers pay a mortgage rate lower than their peers.

4.3 Refinance Decision

All of the mortgages in our sample are prepayable without penalty. Borrowers refinance for a variety of reasons. For example, borrowers can refinance to lower their mortgage interest costs or because they sell their homes and the mortgage is prepaid by invoking its due-on-sale clause. Also, borrowers can cash-out refinance or extract equity from their appreciated property.

We focus on rate refinancing decisions in which borrowers refinance to lower their interest costs or, alternatively, should have refinanced given how high their mortgage note rate is when compared to the prevailing refinancing rate. To do so, any prepayments observed in our data for which the prevailing refinancing rate is at least as large as the mortgage note rate are assumed to be due to home sales or cash-out refinances and are excluded.⁷ By this criterion, we excluded 2.9% of observed prepayments.

A borrower's option to prepay must be sufficiently in-the-money before it is optimal to exercise it. Agarwal, Driscoll, and Laibson (2013) derive a closed-form solution for the optimal mortgage rate at which a borrower should refinance. Using this optimal rate, Agarwal, Rosen, and Yao (2012) document that, on average, a borrower in their sample should have refinanced at an interest rate differential of approximately 150 *bps* lower than the borrower's original mortgage note rate. They conclude that borrowers make an optimal refinancing decision if they refinance within 50 *bps* of this optimal rate.

Given this criterion, we classify borrowers who prepay when their optimal refinance rate is at least 100 *bps* lower than their current mortgage note rate as having made a good refinancing decision. In our sample, approximately 19% of the borrowers made good refinancing decisions.

⁷However, some of the prepayments for which the refinancing rate is less than the borrower's mortgage note rate may have resulted from home sales or cash-out refinancing. Since we do not have explicit information as to the stated purpose of the borrower's refinancing decision, these will also be classified as rate refinancing in our analysis.

By contrast, borrowers prepaying when this interest rate differential is less than 100 *bps* are classified as having made a refinancing mistake. We find that almost 13% of our sampled borrowers responded too eagerly to their prepayment option being in-the-money and prematurely exercised it. However, many, if not most, borrowers in our sample also make a refinancing mistake by simply not exercising their prepayment option when the option is sufficiently in-the-money. To identify this sluggish refinancing behavior, we consider every borrower in our sample who did not prepay by the end of our sample period and check to see whether there were one or more instances when their optimal refinance rate was at least 100 *bps* less than their mortgage note rate. If so, we also classify the borrower as having made a refinancing mistake.⁸ By this criterion, almost 54% of our sampled borrowers made a refinancing mistake. In Figure 3, we see that refinance mistakes decrease in income, FICO score and schooling but are insensitive to age and mortgage importance. Hence, like the mortgage rate decision at purchase, financially sophisticated borrowers appear to be more prone to make good refinancing decisions.

To ensure that our conclusions are not sensitive to the choice of the 100 *bps* interest rate differential between a borrower's optimal refinance rate and their original mortgage note rate, we repeat the analysis with both a tighter criterion of 150 *bps* as well as a looser criterion of only 50 *bps*.

4.3.1. Results

Table 5 presents the results of estimating a Logit model to investigate which of our variables lead to a refinancing mistake as opposed to a good refinancing decision. The most important determinant of a refinancing mistake is whether the borrower is underwater in their mortgage by the end of the sample period. Being underwater in a mortgage is measured by a

⁸Borrowers who do not refinance when their prepayment option is out-of-the-money are not classified as having made a good refinancing decision. In this case, we cannot determine whether this outcome is an explicit financial decision as opposed to simply sluggish behavior on the part of the borrower.

borrower's marked-to-market combined loan-to-value ratio (*MtM-CLTV*). To calculate *MtM-CLTV*, a borrower's remaining mortgage balance is determined according to its initial amortization schedule⁹ and then compared to the property's prevailing value approximated by adjusting its initial purchase price by a ZIP-code level price index. Larger values of *MtM-CLTV* imply greater indebtedness and so the more likely a borrower is underwater (*MtM-CLTV* > 100%). As can be seen in Table 5, greater mortgage indebtedness significantly increases the odds of sluggish refinancing behavior. This makes intuitive sense as being underwater in a mortgage prevents a borrower from qualifying to prepay. Campbell (2006) also finds that borrowers with problem loans refinance sluggishly. However, his estimated effect is far weaker than what we find. This reflects the fact that his sample period coincided with a rise in house prices between 2001 and 2003 while our sample also includes the sharp drop in house prices later in the decade.

Increasing the years of schooling does not appear to significantly affect the nature of a borrower's refinancing decision. This result stands in contrast to Campbell (2006)'s conclusion that better educated borrowers are more likely to promptly refinance their mortgages. Rather, we observe that the channel through which financial sophistication affects a borrower's refinancing decision is through their finance experience attained by owning stock or working in the financial services industry. In either case, the odds of making a good refinancing decision are significantly increased.

With regard to borrower characteristics, we once again observe that older borrowers as well as minority borrowers are more likely to make a financial mistake and prepay sluggishly. Campbell (2006) also concludes that older and non-white borrowers exhibit sluggish prepayment behavior. All of these effects are robust across both the looser as well as tighter criteria.

⁹If a borrower has more than one mortgage loan outstanding, we calculate the remaining balances on all loans.

Finally, higher income does not increase the propensity with which good refinancing decisions are made. However, borrowers with higher FICO scores are significantly likely to make good refinancing decisions. In addition, owning a more valuable home increases the odds of making a good refinancing decision. Intuitively, a more valuable home is more likely to have a larger mortgage and so, all else being equal, the resultant larger dollar interest rate savings prompt a good refinancing decision.

4.3.2. *Inattention versus Refinancing Errors*

To obtain further insights into the refinancing decision, we now investigate what factors are responsible for borrowers waiting too long to refinance, in particular, at rates higher than their corresponding ADL thresholds, referred to as inattention, as opposed to refinancing when rates are lower than their ADL thresholds, referred to as a refinancing error.

From the second to last column of Table 5, we see that a borrower's *MtM-CLTV* is the most important factor explaining inattention. But now the lower *MtM-CLTV*, the more likely the borrower will wait too long to refinance. That is, the less indebted the borrower, the more inattentive they are in their refinancing decision. Similarly, the less valuable the house, the more likely inattention is. We also see that the higher the borrower's income is at refinancing, the more likely inattention.

By contrast, the refinancing decisions of younger borrowers and first-time borrowers, who are likely to be in a more precarious financial situation, are less subject to inattention. Having more than one borrower also makes a household less likely to be inattentive in their refinancing decision.

Financial sophistication appears to make a borrower more inattentive. Increasing years of

schooling increases the likelihood of the borrower waiting too long to refinance. With regard to finance experience, owning stock increases the likelihood of inattention, but this is somewhat offset by the fact that working in financial services tends to decrease this likelihood.

Turning our attention to borrowers making refinance errors, from the last column of Table 5 we have that borrowers with more expensive homes, and so, on average, a larger mortgage are less likely to commit a refinancing error. However, more financially sophisticated borrowers, with more years of schooling or working in financial services or investing in stock, are more likely to make refinancing errors. This stands in contrast to first-time homebuyers who are less likely to make these mistakes.

4.4. Default Decision

We evaluate borrowers' default decisions by determining whether they respond sluggishly to being underwater in their mortgages. Negative equity in a home is a necessary but not sufficient condition to trigger default. There are a number of economic reasons why borrowers should not immediately default including the resultant relocation costs incurred by the household as well as the increased likelihood that the household will have reduced access to credit in the future. However, as emphasized by Guiso, Sapienza, and Zingales (2009), many borrowers consider the decision to default as much a moral as an economic issue. For these households, default is viewed as being morally wrong and is to be avoided even at significant costs.

Borrowers are classified as having made a good default decision if they defaulted when $MtM-CLTV \geq 110\%$. Requiring a borrower's put option to be at least 10% in-the-money before defaulting captures the fact that the default option should be sufficiently before it is optimal to exercise it. This criterion is also consistent with Guiso, Sapienza, and Zingales (2009)'s survey

evidence that no household was willing to default if the equity shortfall in their home was less than 10% of its value. Approximately 3.6% of our sampled borrowers made a good default decision by defaulting when $MtM-CLTV \geq 110\%$.

Conversely, borrowers are classified as having made a default mistake if they have not defaulted when $MtM-CLTV \geq 110\%$. That is, a default mistake requires borrowers not to default even though they were significantly underwater in their mortgages. Almost 5.3% of our sampled borrowers made this default mistake. Borrowers can also make a default mistake if they prematurely exercise their default option when $100 < MtM-CLTV < 110\%$. However, 1.3% of our sampled borrowers exercised their default option too eagerly.¹⁰ In Figure 3, the raw default mistakes are seen to decrease in income, FICO score, schooling, and mortgage importance but are insensitive to a borrower's age. In particular, lower FICO score borrowers appear to be most associated with making default mistakes.

The robustness of our empirical results is assessed by relying on both tighter and looser criteria when classifying default decisions. For the tighter criterion, a default mistake requires a borrower not to default when $MtM-CLTV \geq 120\%$ while a good default decision requires defaulting in this case. Under the looser criterion, a default mistake occurs if the borrower does not default when $MtM-CLTV \geq 105\%$ whereas a borrower defaulting in this case would have made a good default decision.

4.4.1. Results

The results of estimating a Logit model investigating the variables that contribute to the likelihood of a borrower making a default mistake as opposed to not making a mistake by exercising their default option when it is sufficiently in-the-money are provided in Table 6. Like

¹⁰In our subsequent empirical analysis, we combine both categories of default mistakes.

Guiso, Sapienza, and Zingales (2009), our results suggest that moral considerations also play a role in a household's decision to default.

For example, we see that both young borrowers and minority borrowers are less likely to exhibit sluggish default behavior. These conclusions are significant across all *MtM-CLTV* thresholds and are consistent with Guiso, Sapienza, and Zingales (2009)'s survey evidence that young borrowers and African American¹¹ borrowers are less likely to view it morally wrong to default. To ensure that the results do not simply reflect the fact that young borrowers and minority borrowers are more susceptible to losing their jobs and so more likely to default, we also control for the change in a borrower's local unemployment rate.¹² Even though increasing local unemployment does increase the odds that a borrower will default when underwater in their mortgage, the increased propensity of young borrowers and minority borrowers to default less sluggishly remains.

The survey evidence also concludes that wealthier households are more likely to find that default is morally wrong. Our empirical analysis confirms that borrowers with higher incomes are indeed more likely to be sluggish in exercising their in-the-money default option. Alternatively, this result is also consistent with the costs of default being higher for these households, making them more reluctant to default.

Guiso, Sapienza, and Zingales (2009) also conclude that more educated individuals are less likely to think it morally wrong to default, suggesting that these individuals are more likely to exercise their in-the-money default option. However, we find the opposite. In particular, increasing the years of schooling significantly increases the likelihood that the borrower makes a default mistake. These results are consistent with the economic consequences of default being

¹¹This result does not apply to Hispanic borrowers.

¹²Measured by the monthly change in the year-to-year MSA-level unemployment rate.

more important to more educated borrowers.

Financial sophistication attained experientially also contributes to a borrower being sluggish in exercising their in-the-money default option. In general, we would expect financially sophisticated borrowers to be more cognizant of the costs of defaulting and so more reluctant to default. For example, common stock ownership increases the odds of a default mistake. This result is significant across the *MtM-CLTV* thresholds. Working in the financial services industry also increases the odds of making a bad default decision. Being a first-time home who lacks experience doesn't seem to matter when making a default decision.

Other economic considerations, however, also impact the nature of a borrower's default decision. For example, borrowers with higher valued homes are less likely to make a default mistake and so are more likely to exercise their in-the-money default option. Also, those borrowers with interest rate savings available to them, that is, possessing a valuable prepay option, are more likely to be sluggish in defaulting. There are two explanations for this result. The first is consistent with a competing risks story. That is, borrowers with valuable prepay options do not extinguish them by defaulting because they can, alternatively, improve their financial position by refinancing at some future point in time. Second, being underwater in a mortgage prevents a prepayment option from being exercised and so results in potential rate savings being observed for underwater borrowers.

5. Robustness Analysis

We now turn our attention to a closer examination of the financial decisions made by various subgroups of our borrowers. Doing so allow us to better understand the dynamics of why households make mistakes associated with the purchase and financing of their homes. Table 7 reports regressions of the four financial mistakes for, respectively, low income, high FICO score,

more educated, older borrowers, as well as borrowers with high mortgage importance, first-time homebuyers and borrowers in the Sand states (e.g., California, Nevada, Arizona and Florida). Except for first-timer and Sand states, all the subsamples are defined as members of the particular sample that are above (or below in the case of low income) its corresponding median value. The baseline regressions based on the overall sample are used as the benchmarks for comparison purposes.

5.1. Low income

For households with lower income, the odds of overpaying for a house as well as making default mistakes are much greater across all explanatory variables when compared to their baseline. Most of coefficients have similar signs, but their magnitudes are much greater. First-time homebuyers in particular are more likely to obtain an even better bargain if they earn a lower income. For the original mortgage rate and refinance decisions of low income borrowers, financial sophistication obtained experientially, either through stock investment or working in the financial services industry, now does not appear to matter.

5.2. High FICO

Among borrowers with higher FICO scores, the score itself becomes a much more important determinant across all decisions. In particular, it helps making fewer mistakes for mortgage rate and refinance decisions and becomes a more important criteria in house price and default mistakes. Financial sophistication variables including stock investment, finance professionals and income become less important, suggesting this group of borrowers is already financially savvy.

5.3. *More Educated*

For more educated borrowers, years of schooling is more important in explaining financial mistakes compared to the baseline. Borrowers with more years of education are more likely to overpay for their house and make default mistakes, but less likely to make mortgage rate mistakes.

5.4. *Older Borrowers*

Among older borrowers, most financial sophistication variables such as years of schooling, stock investment experience, finance professional background and income, do not matter at all. FICO score, however, is seen to be a more important determinant of avoiding refinance mistakes.

5.5. *Mortgage More Important*

Agarwal, Rosen and Yao (2012) as well as Andersen et al (2014) find that borrowers are less likely to make inattention mistakes in refinancing when a borrower's mortgage obligation becomes more important. For these borrowers, financial sophistication measured by schooling, stock investment and employment in financial services does not explain refinance mistakes. Now the coefficient on FICO score is seen to be significantly positive as opposed to the negative coefficient on FICO score observed for the overall sample. For the other three decisions of these borrowers, the magnitudes of the corresponding coefficients are now much smaller, suggesting that these borrowers are more risk-taking than the overall sample.

5.6. *First-Timer versus Existing Homeowners*

Compared to existing homeowners, first-time homebuyers are considered to lack financial experience and be more financially constrained. Financial sophistication variables including schooling, stock investment and employment in financial services are seen to be more important in explaining the financial mistakes of first-time homebuyers. FICO score is less important, partly reflecting the greater varieties of credit used by this group when compared to existing homeowners. Income is more important as it determines how financially constrained these borrowers are. Age, as expected, is less important since this group consists primarily of younger borrowers.

5.7. *Sand States*

The four Sand states experienced rapid home price growth until 2006 and subsequently saw steep house price declines. There have been very active construction, home purchase and investor activities in these markets before and after the housing bust of 2007-08. With a few exceptions, for this sample, most of our coefficients are larger in magnitude with similar signs compared to the baseline results. Schooling is less important in explaining price and rate decisions. Unlike the overall sample, first-time homebuyers in the Sand states are more likely to make house price mistakes and less likely to make refinancing mistakes. Because of higher home price volatility in these markets, *MtM-CLTV* plays a more important role in explaining refinancing decisions. In particular, following the housing bust, homeowners in the Sand state were effectively unable to refinance because of insufficient home equity.

6. Common Mistakes

The empirical analysis to this point has investigated borrowers' purchase price, mortgage rate, refinance and default decisions one at a time. We now turn our attention to simultaneously analyzing these decisions. That is, are there observable characteristics that impact the likelihood of a household making mistakes across all four decisions?

As we have seen, financial sophistication measured either experientially or by more schooling, does not have a uniform impact across these decisions. While financially sophisticated households are more likely to make good mortgage rate and refinancing decisions, they are also more likely to pay too much for their houses and sluggishly exercise their default options. Only older borrowers and minority borrowers appear to consistently make financial mistakes across a majority of the decisions.

This suggests that the nature of these decisions confronting households differ from one another. Purchasing a home, for example, is an emotional decision. Defaulting on a mortgage is subject to moral considerations while also imposing long-term economic costs on households. Deciding on a mortgage and when to refinance, by contrast, are more analytical decisions and, as such, are more amenable to the analyses that more sophisticated households are able engage in. It would not be surprising then that the characteristics leading to a mistake in one decision make it more likely a good decision is made elsewhere. Our multivariate empirical analysis confirms and characterizes the differences across these household decisions.

6.1. Results

Table 8(b) gives the pair wise correlations between the fitted values of the Logit models corresponding to each of the borrowers' decisions. The results confirm that there does not exist a

combination of household characteristics that can explain all four of the decisions. For example, the characteristics resulting in a borrower making a good house price decision are strongly negatively correlated (-0.40) with those corresponding to a good mortgage rate decision. However, given their positive correlations, a combination of household characteristics appears able to explain mortgage rate and refinancing decisions¹³, while another combination underlies home price and default decisions. We therefore separately investigate joint purchase price and default mistakes and joint mortgage rate and refinance mistakes. These pairs of mistakes are analyzed using both factor analysis as well as non-linear seemingly unrelated regression (Calvet, Campbell, and Sodini (2009)).

The loadings of borrower characteristics on each factor from principal components analysis are tabulated in the first two columns of Table 8(a). In particular, loadings on the factors explaining purchase price and default mistakes are given in the first column, while the second column gives the loadings on the factors explaining mortgage rate and refinancing mistakes. A positive loading is consistent with the characteristic being relevant to the borrower making a financial mistake while a negative loading implies that the characteristic is relevant to a borrower making a good financial decision.

Comparing these loadings makes clear the opposing effects that financial sophistication has on purchase price and default mistakes versus mortgage rate and refinancing mistakes. In particular, years of schooling, being employed in the financial services industry, or investing in common stock all load positively on the factor explaining purchase price and default mistakes but negatively on the factor explaining mortgage rate and refinancing mistakes. In other words, while financial sophistication makes it more likely that the borrower will make a good mortgage

¹³This conclusion is consistent with Guiso, Sapienza, and Zingales (2009) who finds that his variables that predict prompt refinancing behavior also generally predict low self-reported mortgage rates.

rate or refinancing decision, it also makes it more likely that the borrower makes a mistake in the purchase price and default decisions. These opposing effects preclude a single combination of borrower characteristics explaining mistakes across all four of the decisions.

Other borrower characteristics also load oppositely on these factors. Being a first-time homebuyer and being a minority borrower both load positively on the factor explaining mortgage rate and refinancing mistakes but negatively on the factor explaining purchase price and default mistakes. Conversely, having more than one borrower loads positively on the factor explaining purchase price and default mistakes but negatively on the factor explaining mortgage rate and refinancing mistakes.

However, some borrower characteristics load in the same direction on both factors. Being a young borrower loads negatively on both factors while, by contrast, being an older borrower loads positively on both factors. That is, older borrowers tend to make mistakes in all of the decisions while young borrowers do not. House price loads negatively on both, though it appears to be more relevant to the factor explaining rate and refinancing mistakes. On the other hand, income loads positively on both but income is far more relevant to the factor explaining purchase price and default mistakes. So while income and house price are positively correlated, controlling for both, we see that borrowers with higher incomes tend to consistently make mistakes, while borrowers with higher priced homes make good decisions throughout.

To ensure the robustness of these results, we also regress the vector of mortgage rate and refinancing mistakes and, separately, the vector of house purchase price and default mistakes against a single linear combination of borrower characteristics. We estimate these systems of equations by non-linear seemingly unrelated regression (NL-SUR). The estimated coefficients of the house purchase price and default mistakes are given in the last two columns of Table 8(a).

The final column of this table gives the estimated coefficients of the mortgage rate and refinancing mistakes. As before, a positive coefficient is consistent with the characteristic leading to a mistake while a negative coefficient contributes to a good decision.

On the whole, these estimation results confirm our previous results obtained using principal components factoring. Financially sophisticated borrowers are more likely to make mistakes in house purchase price or default decisions, but more likely to make good mortgage rate and refinancing decisions. Young borrowers tend to make good decisions throughout while older borrowers and minority borrowers consistently make mistakes. Higher income, all else being equal, increases the likelihood of mistakes while higher house price, all else being equal, increases the likelihood of a good financial decision.

7. Conclusions

It is generally acknowledged that poorer and less educated households are more likely to make mistakes in their financial decisions than wealthier and better educated households. Consistent with this, we find that financially sophisticated households are indeed less likely to pay too high a mortgage rate or not refinance when it is financially advantageous to do so. However, these are precisely the households that are more likely to over pay for a house and less likely to default when significantly underwater in their mortgage.

That well educated borrowers are less likely to pay too high a mortgage rate or not refinance when financially advantageous to do so suggests that making better mortgage rate and refinancing decisions can be learned. In fact, our analysis confirms that first-time homebuyers, considered to be less financially sophisticated, learn to make better mortgage rate and refinancing decisions by their subsequent purchases. Learning to choose the right mortgage is an important financial decision making skill that households need if they are to avoid the financial

distress many found themselves in after the housing bust of 2007-08.

Even though financially sophisticated households overpay for their homes and do not learn to reduce their propensity to overpay, we do provide evidence that this financial mistake can potentially be mitigated. In particular, we find that first-time homebuyers who, by definition, have the least experience in purchasing a house, are more likely to make a good house purchase price decision, suggesting that they expend the time and effort necessary to avoid overpaying for a home.

Finally, to prescribe that financially sophisticated households should be more aggressive in exercising their default option may ignore the costs associated with default. These costs are potentially higher for wealthier and better educated households and the attendant social stigma more severe. Only by considering all of these costs can we better understand why some households default when underwater in their mortgage while others do not.

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Figure 1 Financial decisions for buying and owning a home

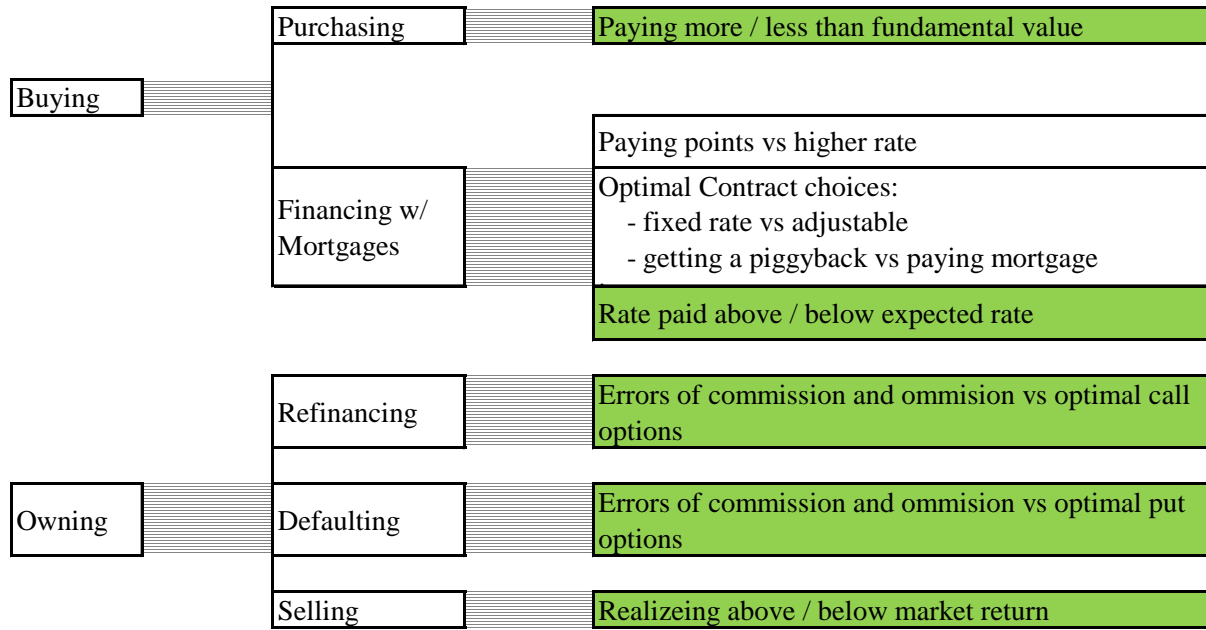
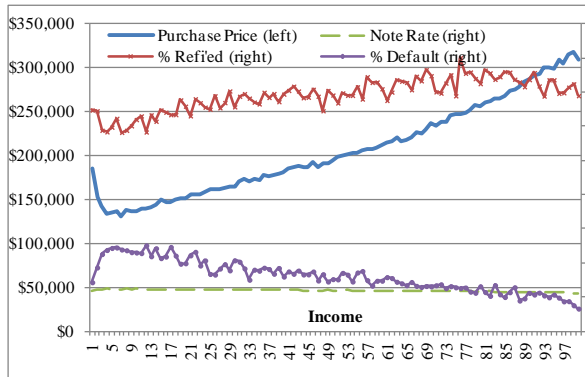
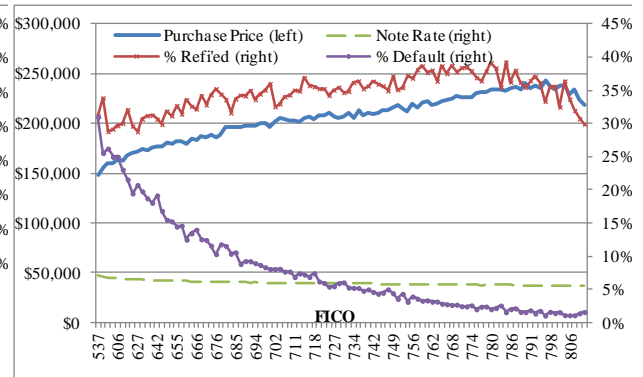


Figure 2 Raw Statistics by Measures of Financial Sophistication

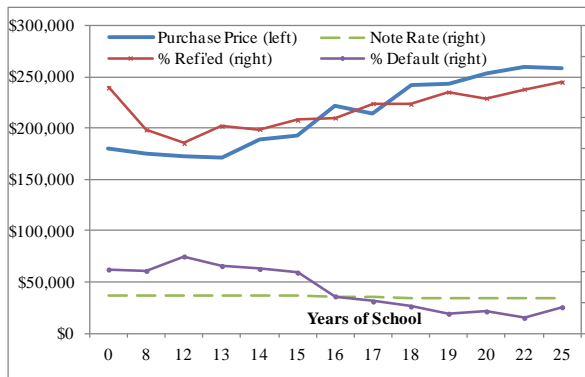
(a)



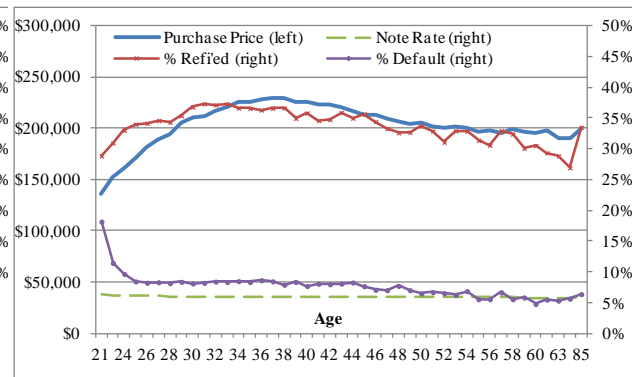
(b)



(c)



(d)



(e)

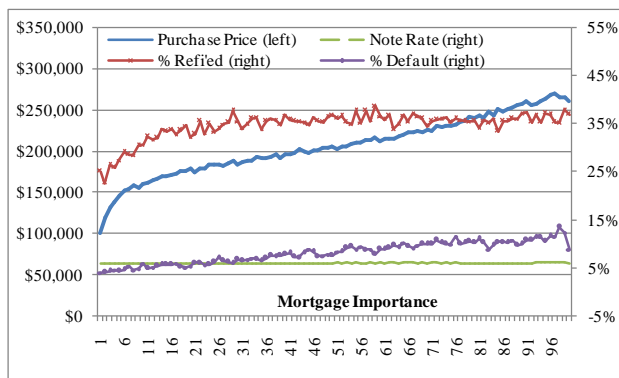
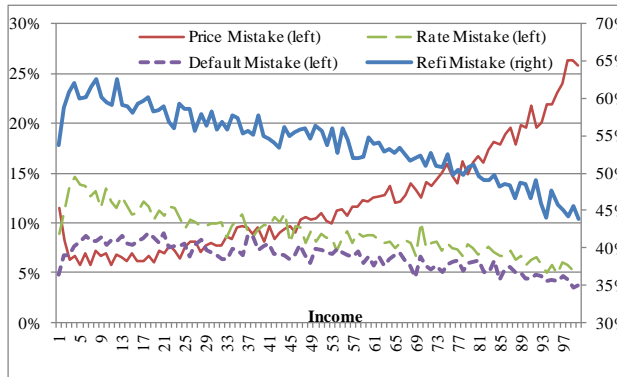
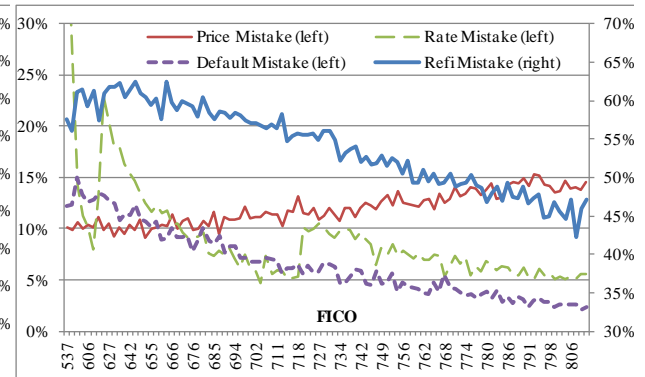


Figure 3 Financial Mistakes by Measures of Financial Sophistication

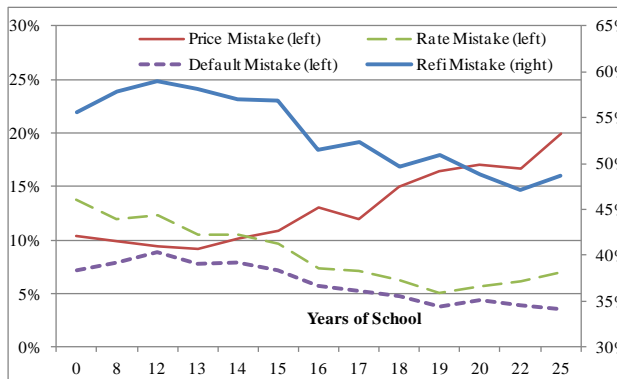
(a)



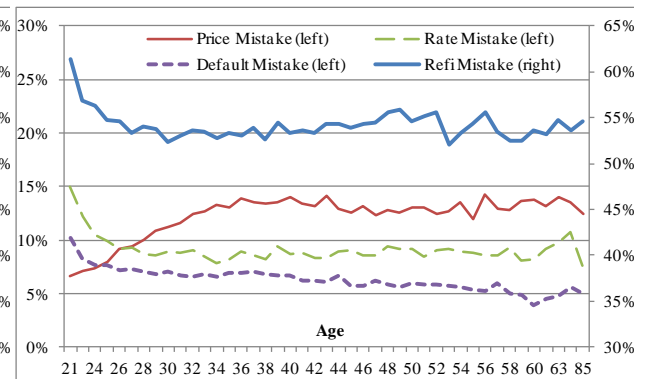
(b)



(c)



(d)



(e)

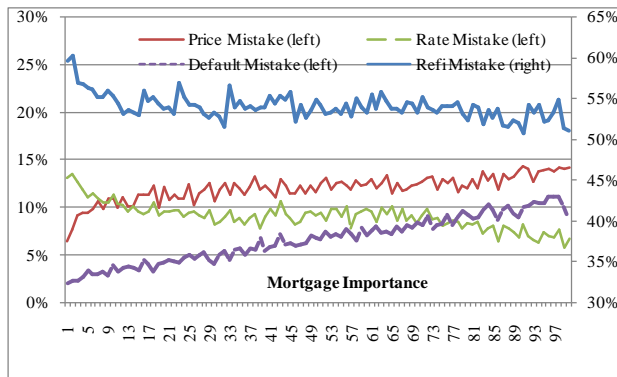


Table 1 Descriptive Statistics

Variable	N	mean	sd	min	p25	p50	p75	max
Purchase price	266,110	206,251	104,579	13,474	130,000	182,600	263,895	981,471
Original note rate	266,110	5.940	0.787	2.38	5.50	6.00	6.50	8.63
Income (monthly)	266,110	4892.17	3216.79	0.00	3,000	4,200	6,000	166,000
FICO	266,110	719.765	61.771	338.00	677.00	729.00	771.00	893.00
Age	266,110	38.588	11.546	18.00	30.00	36.00	46.00	99.00
Young household	266,110	0.467	0.499	0	0	0	1	1
Old household	266,110	0.017	0.129	0	0	0	0	1
Years of school	266,110	14.538	3.911	0	12	16	16	99
Highschool diploma	266,110	0.541	0.498	0	0	1	1	1
College degree	266,110	0.186	0.389	0	0	0	0	1
First-time homebuyer	266,110	0.412	0.492	0	0	0	1	1
Minority	266,110	0.150	0.357	0	0	0	0	1
Multiple borrowers	266,110	0.332	0.471	0	0	0	1	1
% Stock in total asset	266,110	0.031	0.138	0.00	0.00	0.00	0.00	1
Own stocks	266,110	0.062	0.242	0	0	0	0	1
% Real estate in total asset	266,110	0.068	0.226	0.00	0.00	0.00	0.00	1
Financial services professional	266,110	0.083	0.276	0	0	0	0	1
Log(price)	266,110	12.109	0.520	9.51	11.78	12.12	12.48	13.80
Log(income)	264,764	8.347	0.579	-4.61	8.01	8.35	8.70	12.02
Combined LTV	266,110	0.870	0.134	0.03	0.80	0.90	0.99	1.05
Marked to market CLTV	266,110	0.598	0.450	0.00	0.00	0.73	0.91	1.87
Rates saved	266,110	-1.234	1.027	-3.41	-1.94	-1.29	-0.65	1.96
Change in unemployment rate	265,828	2.045	2.517	-14.39	-0.26	2.17	3.95	15.59
(Purchase price - AVM)/ Price	266,110	-0.046	0.222	-6.36	-0.12	-0.01	0.08	0.78
Note rate - predicted rate	266,110	-0.005	0.374	-1.06	-0.25	-0.02	0.23	1.16
Default	266,110	0.081	0.272	0	0	0	0	1
Refi or not	266,110	0.346	0.476	0	0	0	1	1
Price appreciation for resales	35,699	0.209	0.345	-0.39	0.00	0.08	0.32	1.81

Table 2 Differences in Household Characteristics

	Differences between bad and good decisions:			
	Price	Rate	Refinance	Default
Purchase price	128,508	(47,945)	(21,560)	(7,156)
Original note rate	-0.210	1.278	-0.246	-0.136
Income (monthly)	1937.33	-593.80	-276.09	10.01
FICO	13.232	-6.208	-8.523	15.478
Age	1.208	0.425	0.360	0.527
Young household	-0.058	-0.012	-0.010	-0.017
Old household	0.000	0.004	0.004	0.002
Years of schooling	0.998	-1.015	-0.234	0.304
High School diploma	0.028	-0.057	-0.014	0.010
College degree	0.093	-0.068	-0.023	0.025
First-time homebuyer	-0.097	0.069	0.036	-0.003
Minority	-0.022	0.093	0.049	-0.041
Multiple borrowers	0.134	-0.146	-0.077	0.010
% Stock in total asset	0.008	-0.011	-0.005	0.005
Own stocks	0.016	-0.023	-0.012	0.012
% Real estate in total asset	0.041	-0.037	-0.015	-0.002
Financial services professional	0.006	-0.019	-0.007	0.017
Log(price)	0.699	-0.287	-0.116	-0.045
Log(income)	0.379	-0.124	-0.056	0.001
CLTV	-0.034	0.014	0.011	-0.009
Marked to market CLTV	-0.067		0.211	-0.120
Rates saved	0.231		3.301	0.491
Change in unemployment rate	0.160	-0.726	-0.397	-0.592
(Purchase price - AVM)/ Price	0.580***	0.130	0.095	-0.031
Note rate - predicted rate	-0.081	1.385***	-0.082	-0.045
Default	0.022	0.068	0.115	-0.804***
Refinance or not	0.052	0.070	-0.770***	0.088
Price appreciation for resale	-0.166			

*** Indicates statistical significance at the 1% level.

Table 3 Purchase Price Mistakes

	(1) Base	(2) Looser	(3) Tighter	(4) Appreciation
Age	-0.003 (-0.11)	0.013 (0.71)	0.084 (1.64)	-0.091*** (-14.54)
Years of schooling	0.827*** (17.59)	0.547*** (18.88)	1.147*** (13.46)	0.034*** (3.61)
First-time homebuyer	-0.036* (-2.06)	-0.037*** (-3.39)	0.018 (0.58)	0.009* (2.25)
Minority	0.125*** (5.51)	0.079*** (5.49)	0.254*** (6.59)	0.016** (2.92)
# Borrowers	0.696*** (40.78)	0.522*** (47.88)	0.767*** (25.59)	0.002 (0.52)
Stock dummy	0.124*** (3.88)	0.054** (2.63)	0.082 (1.47)	0.012* (2.03)
Fin services dummy	0.012 (0.42)	0.040* (2.27)	-0.067 (-1.31)	0.008 (1.40)
Log(FICO)	0.767*** (7.81)	0.627*** (10.10)	0.840*** (4.83)	0.136*** (6.65)
Log(Income)	1.211*** (72.51)	0.878*** (83.15)	1.376*** (47.11)	0.026*** (7.56)
Log(House value)				-0.148*** (-38.15)
YYQQ FE	Y	Y	Y	Y
State FE	Y	Y	Y	Y
Observations	84360	181094	38540	35491
R square	0.104	0.060	0.129	0.223

*** Indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 4 Mortgage Rate Mistakes

	(1) Base	(2) Looser	(3) Tighter
Age	0.205*** (5.29)	0.185*** (8.07)	0.299*** (4.06)
Years of schooling	-0.655*** (-11.02)	-0.507*** (-14.45)	-0.640*** (-5.83)
First-time homebuyer	0.145*** (6.38)	0.120*** (8.93)	0.149*** (3.47)
Minority	0.402*** (14.59)	0.333*** (19.30)	0.529*** (10.46)
# Borrowers	-0.426*** (-17.60)	-0.288*** (-20.55)	-0.523*** (-11.20)
Stock dummy	-0.206*** (-4.57)	-0.171*** (-6.60)	-0.162 (-1.94)
Fin services dummy	-0.156*** (-4.09)	-0.133*** (-5.96)	-0.173* (-2.39)
Log(FICO)	0.099 (0.89)	1.082*** (15.07)	-1.466*** (-7.41)
Log(Income)	0.108*** (4.82)	0.036** (2.80)	0.177*** (4.09)
Log(House value)	-1.195*** (-44.60)	-0.961*** (-60.93)	-1.267*** (-24.62)
YYQQ FE	Y	Y	Y
State FE	Y	Y	Y
Observations	44820	120758	13645
R square	0.120	0.078	0.169

*** Indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 5 Refinance Mistakes

	(1)	(2)	(3)	(4)	(5)
	Base	Looser	Tighter	Inattention	Refi Error
Age	0.126*** (5.89)	0.127*** (7.15)	0.134*** (7.73)	-0.796*** (-6.55)	-0.039 (-1.77)
Years of schooling	-0.029 (-0.89)	-0.041 (-1.52)	-0.027 (-1.03)	0.893*** (5.03)	0.066* (2.10)
First-time homebuyer	0.046*** (3.70)	0.081*** (7.78)	0.092*** (9.04)	-0.387*** (-5.69)	-0.077*** (-6.49)
Minority	0.109*** (6.26)	0.158*** (11.07)	0.176*** (12.61)	-0.160 (-1.47)	-0.102*** (-5.63)
# Borrowers	-0.134*** (-10.69)	-0.204*** (-19.48)	-0.215*** (-21.05)	-0.787*** (-11.74)	0.012 (1.01)
Stock dummy	-0.049* (-2.16)	-0.061** (-3.23)	-0.052** (-2.85)	0.602*** (5.33)	0.039* (2.00)
Fin services dummy	-0.041* (-2.05)	-0.055** (-3.25)	-0.052** (-3.16)	-0.283** (-2.72)	0.005 (0.29)
Log(FICO)	-0.277*** (-3.92)	-1.055*** (-17.93)	-1.129*** (-19.60)	-0.585 (-1.34)	-0.048 (-0.66)
Log(Income)	-0.000 (-0.04)	0.009 (0.88)	-0.002 (-0.23)	-0.195** (-2.87)	0.014 (1.29)
Log(House value)	-0.408*** (-27.42)	-0.671*** (-53.54)	-0.618*** (-50.46)	-2.629*** (-28.85)	-0.280*** (-11.19)
<i>MtM-CLTV</i>	1.029*** (78.82)	0.610*** (54.96)	0.709*** (65.39)	-8.464*** (-48.82)	-0.162 (-1.93)
Income at Refi				1.379*** (17.65)	
Inattention					0.009 (0.95)
YYQQ FE	Y	Y	Y	Y	Y
State FE	Y	Y	Y	Y	Y
Observations	185960	237190	251403	52657	52658
R square	0.105	0.136	0.135	0.453	0.291

*** Indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 6 Default Mistakes

	(1)	(2)	(3)
	Base	Looser	Tighter
Age	0.188*** (3.62)	0.178*** (3.69)	0.209** (3.29)
Years of schooling	0.462*** (5.83)	0.566*** (7.68)	0.282** (2.89)
First-time homebuyer	0.050 (1.64)	0.070* (2.49)	-0.038 (-1.02)
Minority	-0.195*** (-6.16)	-0.194*** (-6.56)	-0.219*** (-5.64)
# Borrowers	0.304*** (8.63)	0.370*** (11.33)	0.134** (3.11)
Stock dummy	0.237** (3.16)	0.287*** (4.11)	0.083 (0.90)
Financial svcs dummy	0.200*** (3.58)	0.127* (2.50)	0.058 (0.83)
Log(FICO)	4.292*** (25.04)	4.900*** (30.85)	3.393*** (15.88)
Log(Income)	0.125*** (3.78)	0.095** (3.07)	0.079* (1.99)
Log(House value)	-0.507*** (-11.65)	-0.477*** (-11.87)	-0.456*** (-8.39)
Rate savings	0.253*** (25.46)	0.261*** (28.01)	0.214*** (17.38)
Unemployment change	-0.201*** (-18.32)	-0.178*** (-18.04)	-0.296*** (-21.25)
YYQQ FE	Y	Y	Y
State FE	Y	Y	Y
Observations	25592	29980	19321
R square	0.090	0.089	0.149

*** Indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 7a Robustness Analysis

	Baseline				Lower Income			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	price	rate	refi	default	price	rate	refi	default
Age	-0.003 (-0.11)	0.205*** (5.29)	0.126*** (5.89)	0.188*** (3.62)	0.250*** (6.02)	0.182*** (3.60)	0.118*** (4.13)	0.197** (2.91)
Yrs of schooling	0.827*** (17.59)	-0.655*** (-11.02)	-0.029 (-0.89)	0.462*** (5.83)	1.043*** (14.08)	-0.624*** (-7.58)	-0.066 (-1.46)	0.354** (3.24)
First-time homebuyer	-0.036* (-2.06)	0.145*** (6.38)	0.046*** (3.70)	0.050 (1.64)	-0.209*** (-8.11)	-0.023 (-0.74)	0.066*** (3.81)	0.043 (1.05)
Minority	0.125*** (5.51)	0.402*** (14.59)	0.109*** (6.26)	-0.195*** (-6.16)	0.228*** (7.09)	0.325*** (8.89)	0.110*** (4.66)	-0.130** (-3.09)
# Borrowers	0.696*** (40.78)	-0.426*** (-17.60)	-0.134*** (-10.69)	0.304*** (8.63)	0.902*** (34.97)	-0.288*** (-8.44)	-0.153*** (-8.25)	0.290*** (6.13)
Stock dummy	0.124*** (3.88)	-0.206*** (-4.57)	-0.049* (-2.16)	0.237** (3.16)	0.136* (2.53)	-0.065 (-0.93)	-0.028 (-0.81)	0.380*** (3.39)
Fin svcs dummy	0.012 (0.42)	-0.156*** (-4.09)	-0.041* (-2.05)	0.200*** (3.58)	0.020 (0.44)	-0.172** (-3.23)	-0.026 (-0.86)	0.251** (3.25)
Log(FICO)	0.767*** (7.81)	0.099 (0.89)	-0.277*** (-3.92)	4.292*** (25.04)	0.851*** (5.91)	0.741*** (4.97)	0.131 (1.36)	3.877*** (17.12)
Log(Income)	1.211*** (72.51)	0.108*** (4.82)	-0.000 (-0.04)	0.125*** (3.78)	0.606*** (17.03)	0.054 (1.51)	-0.026 (-1.36)	0.122* (2.42)
Log(House value)		-1.195*** (-44.60)	-0.408*** (-27.42)	-0.507*** (-11.65)		-1.345*** (-34.18)	-0.377*** (-17.16)	-0.494*** (-8.14)
<i>MtM-CLTV</i>			1.029*** (78.82)				1.045*** (55.96)	
Rate savings				0.253*** (25.46)				0.224*** (17.31)
Unemployment change				-0.201*** (-18.32)				-0.231*** (-15.57)
YYQQ FE	Y	Y	Y	Y	Y	Y	Y	Y
State FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	84360	44820	185960	25592	43863	24073	95367	14420
R square	0.104	0.120	0.105	0.090	0.059	0.122	0.099	0.088

*** Indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 7b Robustness Analysis

	Higher FICO				More Educated			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	price	rate	refi	default	price	rate	refi	default
Age	-0.110** (-2.58)	0.377*** (5.60)	0.136*** (4.26)	-0.039 (-0.35)	-0.046 (-1.36)	0.252*** (5.38)	0.103*** (4.09)	0.099 (1.50)
Yrs of schooling	0.851*** (12.96)	* (-6.79)	-0.028 (-0.60)	* (4.27)	1.131** (13.61)	-0.789** (-6.82)	-0.035 (-0.58)	0.783*** (4.65)
First-time homebuyer	0.001 (0.02)	0.108** (2.75)	0.057** (3.10)	0.161* (2.48)	* (-2.71)	0.170*** (6.30)	0.045** (3.17)	0.073 (1.95)
Minority	-0.150** (-3.88)	0.388*** (6.80)	0.229*** (7.52)	* (-3.00)	0.072** (2.65)	0.432*** (12.76)	0.090*** (4.32)	* (-6.02)
# Borrowers	0.741*** (31.35)	-0.127** (-3.20)	* (-10.56)	* (6.18)	0.697** (35.66)	-0.413** (-14.44)	-0.144** (-10.08)	0.315*** (7.17)
Stock dummy	0.137*** (3.32)	-0.137* (-2.07)	-0.040 (-1.35)	0.033 (0.27)	0.123** (3.54)	-0.185** (-3.72)	-0.056* (-2.26)	0.299*** (3.38)
Fin svcs dummy	0.029 (0.78)	-0.118* (-1.97)	-0.060* (-2.17)	0.099 (0.90)	0.006 (0.20)	* (-3.95)	-0.035 (-1.58)	0.184** (2.84)
Log(FICO)	2.790*** (7.39)	* (-9.16)	* (-9.08)	* (7.85)	0.915** (7.92)	0.094 (0.70)	* (-6.22)	4.521*** (21.22)
Log(Income)	1.116*** (49.29)	0.032 (0.88)	0.037* (2.35)	* (4.92)	1.188** (61.69)	0.080** (3.03)	0.021 (1.56)	0.137*** (3.39)
Log(House value)		-1.392** (-31.97)	-0.501** (-23.74)	-0.530*** (-5.93)		-1.161** (-36.95)	-0.428** (-24.78)	-0.465** (-8.59)
<i>MtM-CLTV</i>			1.025*** (54.14)				0.979*** (65.74)	
Rate savings				0.298** (12.00)				0.261*** (20.65)
Unemployment change				-0.253*** (-9.99)				-0.225** (-15.90)
YYQQ FE	Y	Y	Y	Y	Y	Y	Y	Y
State FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	41611	16926	89369	6661	62025	32199	138728	16945
R square	0.097	0.148	0.131	0.090	0.096	0.114	0.106	0.092

*** Indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 7c Robustness Analysis

	Older				Mortgage More Important			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	price	rate	refi	default	price	rate	refi	default
Age	0.339 (1.74)	-0.028 (-0.10)	0.248 (1.63)	-0.480 (-1.13)	-0.092* (-2.00)	0.164** (3.15)	0.178*** (5.51)	0.114 (1.86)
Yrs of schooling	0.908*** (6.63)	-0.353 (-1.82)	-0.171 (-1.59)	-0.231 (-0.72)	0.638*** (8.80)	-0.684*** (-8.51)	-0.014 (-0.30)	0.480*** (5.09)
First-time homebuyer	0.051 (0.85)	0.174* (1.96)	-0.019 (-0.38)	0.018 (0.15)	-0.034 (-1.27)	-0.011 (-0.35)	0.068*** (3.69)	0.079* (2.20)
Minority	0.107 (1.51)	0.421*** (4.22)	0.052 (0.85)	-0.031 (-0.24)	0.314*** (10.22)	0.388*** (11.40)	0.106*** (4.70)	-0.177*** (-4.88)
# Borrowers	0.545*** (10.68)	-0.366*** (-4.54)	-0.106* (-2.51)	0.375** (2.83)	0.734*** (26.25)	-0.515*** (-15.07)	-0.120*** (-5.96)	0.315*** (7.18)
Stock dummy	0.092 (0.90)	0.124 (0.80)	-0.172* (-2.31)	-0.197 (-0.69)	0.034 (0.60)	-0.152* (-2.25)	0.010 (0.25)	0.213* (2.17)
Fin svcs dummy	0.013 (0.13)	0.430** (2.94)	-0.093 (-1.24)	-0.129 (-0.60)	-0.054 (-1.18)	-0.155** (-2.95)	0.006 (0.19)	0.219** (3.25)
Log(FICO)	1.702*** (5.34)	0.510 (1.29)	-0.878*** (-3.51)	4.202*** (6.46)	-0.874*** (-5.98)	0.383* (2.52)	0.869*** (8.62)	3.635*** (17.63)
Log(Income)	0.743*** (17.88)	0.002 (0.03)	0.046 (1.41)	0.119 (1.04)	1.405*** (49.37)	0.220*** (6.64)	-0.031 (-1.59)	0.088* (2.18)
Log(House value)		-0.851*** (-10.39)	-0.486*** (-10.19)	-0.671*** (-4.30)		-1.096*** (-28.64)	-0.315*** (-13.56)	-0.652*** (-12.31)
<i>MtM-CLTV</i>			1.126*** (23.89)				0.921*** (48.00)	
Rate savings				0.313*** (7.60)				0.234*** (20.74)
Unemployment change				-0.172*** (-3.93)				-0.215*** (-16.56)
YYQQ FE	Y	Y	Y	Y	Y	Y	Y	Y
State FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	8715	3695	16683	1782	38946	24807	85337	17950
R square	0.078	0.107	0.129	0.102	0.108	0.110	0.084	0.098

*** Indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 7d Robustness Analysis

	First Timer				Sand States			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	price	rate	refi	default	price	rate	refi	default
Age	0.075 (1.58)	0.214*** (3.70)	0.096** (2.90)	0.177* (2.54)	0.017 (0.28)	0.118 (1.46)	-0.120* (-2.24)	0.397*** (4.76)
Yrs of schooling	0.543*** (7.14)	-0.791*** (-8.58)	-0.090 (-1.78)	0.528*** (4.92)	0.462*** (4.76)	-0.433*** (-3.50)	-0.107 (-1.29)	0.511*** (3.95)
First-time homebuyer					0.262*** (6.94)	0.249*** (5.01)	-0.047 (-1.46)	0.041 (0.82)
Minority	0.322*** (9.07)	0.435*** (10.91)	0.116*** (4.45)	-0.199*** (-4.75)	-0.072 (-1.70)	0.470*** (8.89)	-0.008 (-0.22)	-0.185*** (-3.58)
# Borrowers	0.754*** (24.47)	-0.375*** (-9.51)	-0.149*** (-7.11)	0.310*** (6.14)	0.384*** (9.85)	-0.489*** (-9.35)	0.007 (0.20)	0.276*** (5.01)
Stock dummy	0.160** (2.84)	-0.265*** (-3.56)	-0.070 (-1.88)	0.378*** (3.54)	0.222** (3.12)	-0.275** (-2.89)	-0.092 (-1.65)	0.264* (2.23)
Fin svcs dummy	0.014 (0.30)	-0.228*** (-4.00)	-0.024 (-0.76)	0.254*** (3.34)	-0.011 (-0.18)	-0.134 (-1.55)	0.010 (0.18)	0.043 (0.47)
Log(FICO)	0.398* (2.47)	-0.230 (-1.33)	-0.210 (-1.89)	4.401*** (18.74)	0.511* (2.25)	0.518* (2.02)	1.960*** (10.75)	4.412*** (14.86)
Log(Income)	1.683*** (53.61)	0.404*** (9.74)	-0.050* (-2.28)	0.117* (2.38)	0.897*** (25.99)	0.212*** (4.51)	-0.002 (-0.07)	0.133** (2.65)
Log(House value)		-1.307*** (-27.78)	-0.430*** (-16.16)	-0.563*** (-8.81)		-0.969*** (-16.22)	-0.442*** (-10.79)	-0.735*** (-10.07)
<i>MtM-CLTV</i>			0.994*** (50.31)				1.099*** (33.30)	
Rate savings				0.244*** (19.03)				0.401*** (22.57)
Unemployment change				-0.208*** (-13.95)				-0.192*** (-11.06)
YYQQ FE	Y	Y	Y	Y	Y	Y	Y	Y
State FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	34218	20074	77697	14272	16370	9515	37531	9085
R square	0.137	0.133	0.108	0.094	0.056	0.098	0.130	0.115

*** Indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 8 Factor Analysis of Multiple Mistakes

(a) Factor Analysis

	Principal Components		Non-Linear - SUR	
	(1) Price & Default	(2) Rate & Refi	(3) Price & Default	(4) Rate & Refi
Age	0.111***	0.397***	0.0005	0.264***
Years of schooling	1.068***	-0.624***	0.826***	-0.781**
First-time homebuyer	-0.045***	0.260***	-0.023***	0.203***
Minority	-0.055***	0.481***	0.106***	0.456***
# Borrowers	0.739***	-0.480***	0.684***	-0.478***
Stock dummy	0.255***	-0.351***	0.143***	-0.270***
Fin services dummy	0.146***	-0.171***	0.023***	-0.194***
Log(FICO)	3.571***	0.936***	1.044***	0.445***
Log income	1.127***	0.088***	1.158***	0.068***
Log house value	-0.362***	-0.812***	0.034***	-0.925***
Constant	-32.017***	3.210***	-20.000***	8.790***
Observations	233808	251403	233808	251403
Adjusted R-squared	0.725	0.367	0.941	0.582

(b) Coefficients of Correlation among predicted financial mistakes

	Price	Rate	Refi	Default
Price	1			
Rate	-0.40	1		
Refi	-0.20	0.4	1	
Default	0.07	-0.11	0.04	1